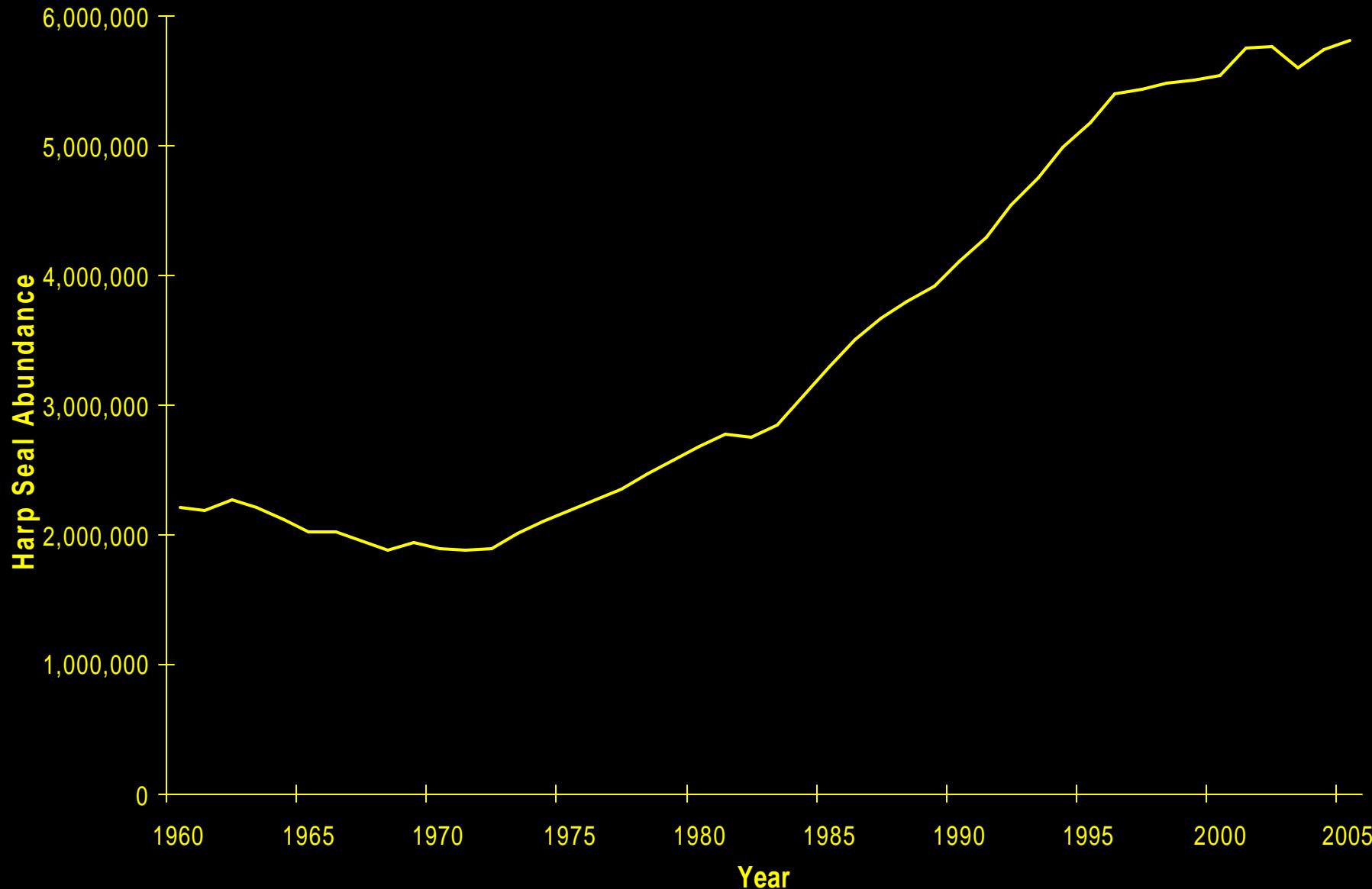
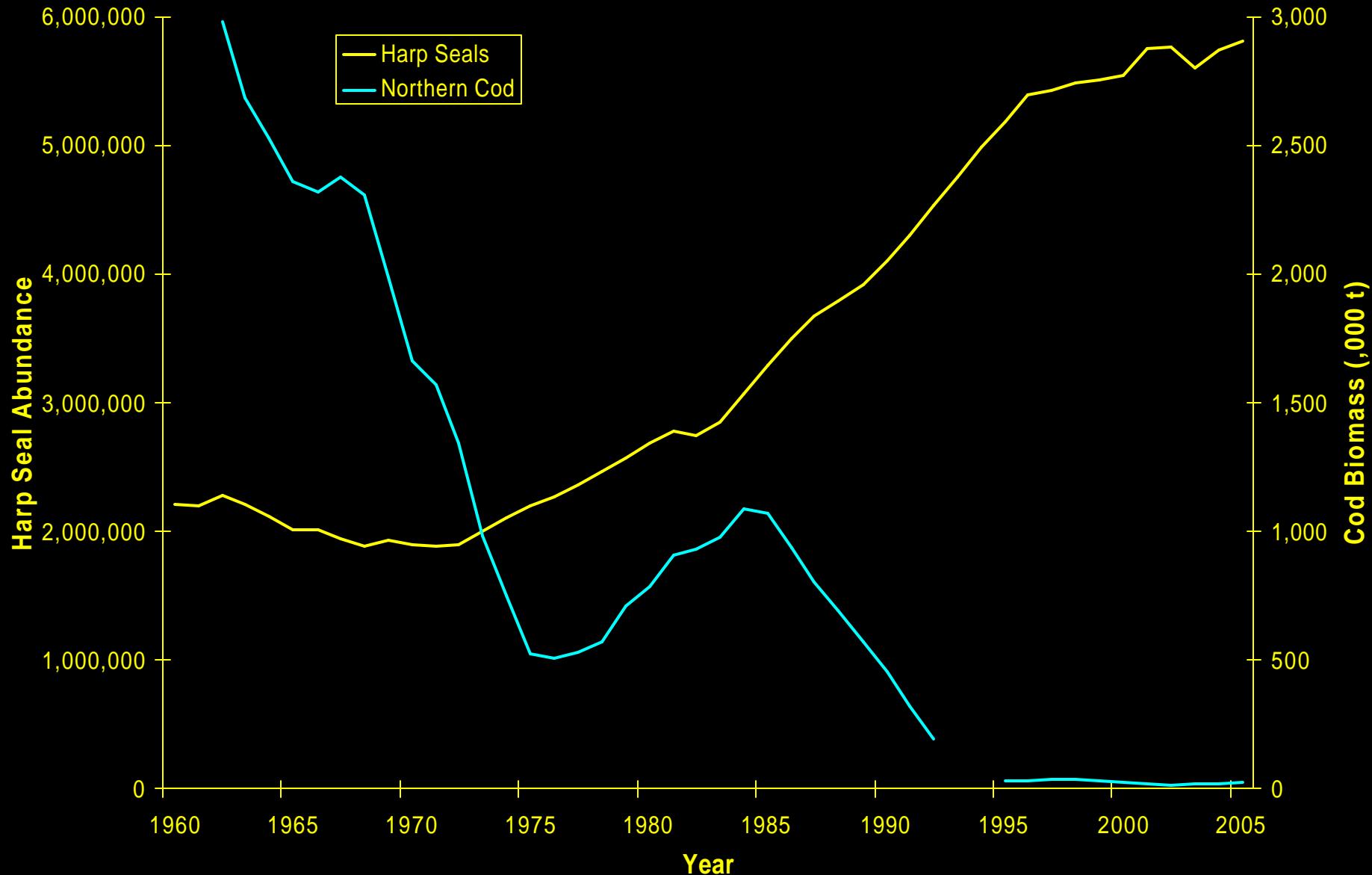


Determining the Role of Harp Seals in the NW Atlantic Ecosystem



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Take Home Messages

- A wide variety of data are required to determine ecological roles
- Data are highly variable in time and space
- The reasons for this variability are often unknown and unpredictable
- Generally, we know a lot more about some species (e.g. marine mammals) than other components of the ecosystem
- We have to be careful not to compare apples with oranges

Ecological Role of Harp Seals

Data Needs:

- **Population dynamics**
- **Energy requirements,
growth and condition**
- **Distribution and
habitat use**
- **Diet/Foraging ecology**
- **Ecosystem modelling**



Population Dynamics

- Total removals by age
- Annual age-specific reproductive rates
- Independent estimates of pup production



Mortality of NW Atlantic Harp Seals

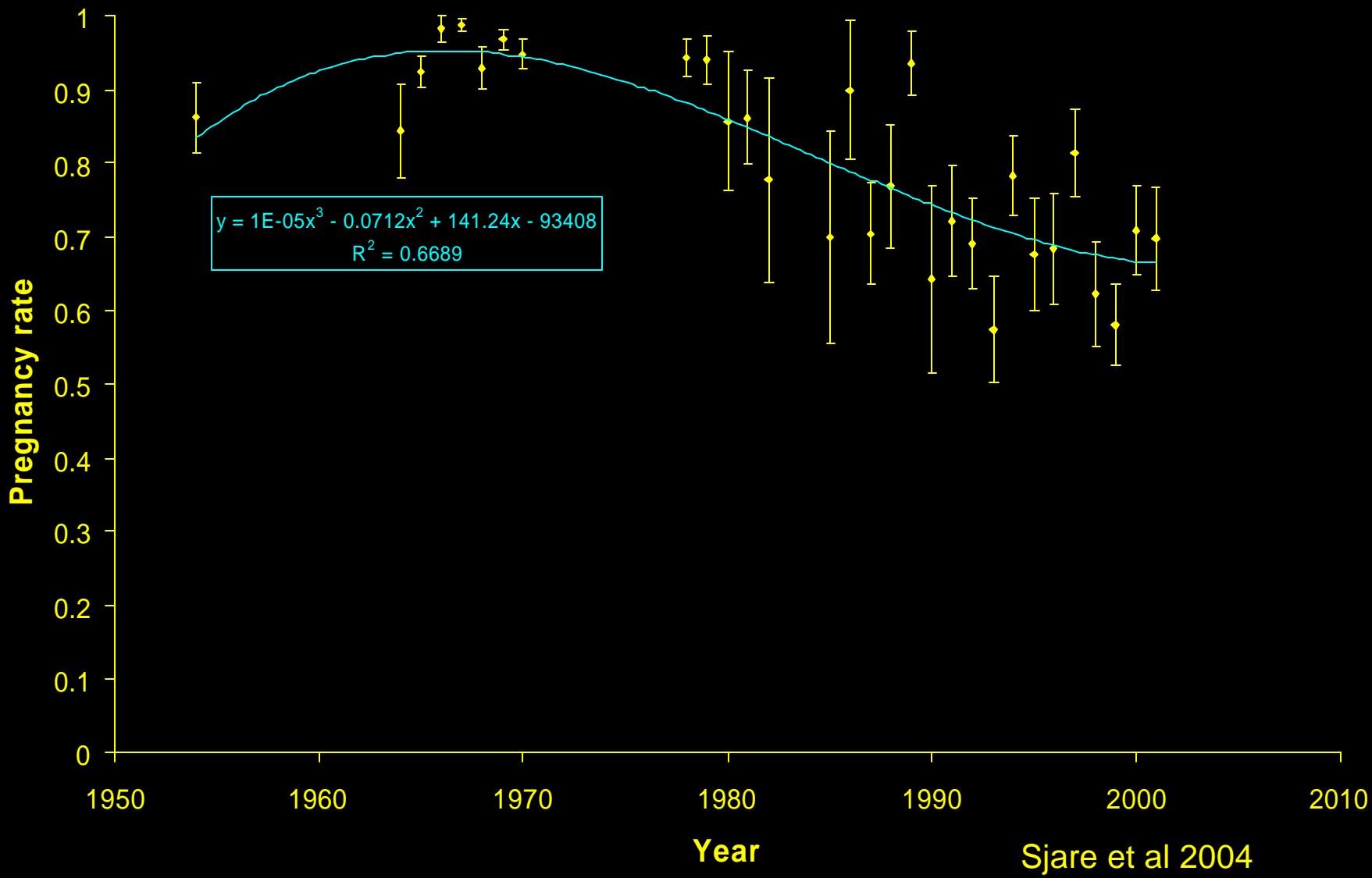
Human Induced:

- Catches in southern Canada, Canadian Arctic and Greenland (reported and unreported)
- Bycatch in commercial fisheries

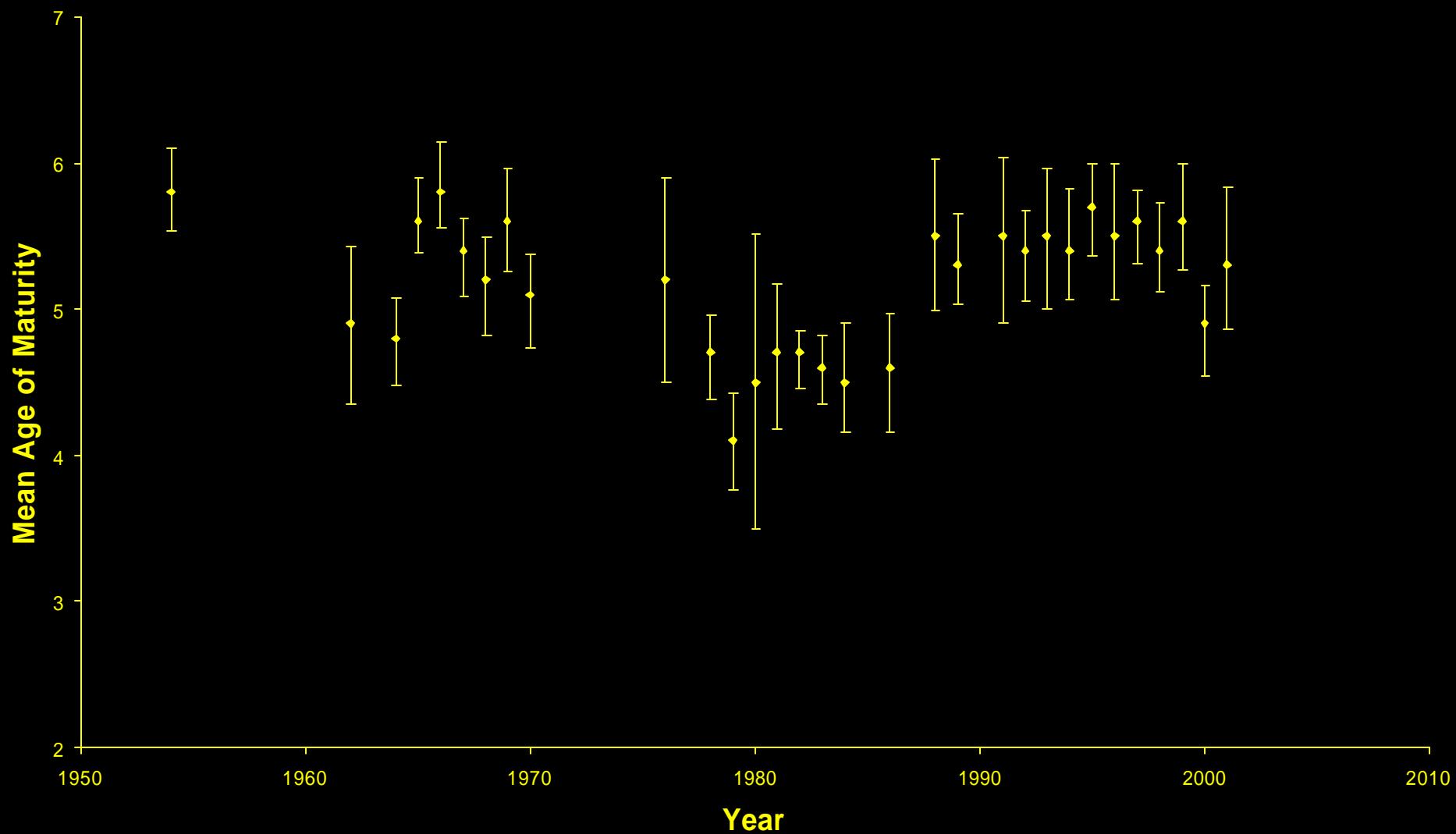
Environmental Induced:

- Poor ice conditions

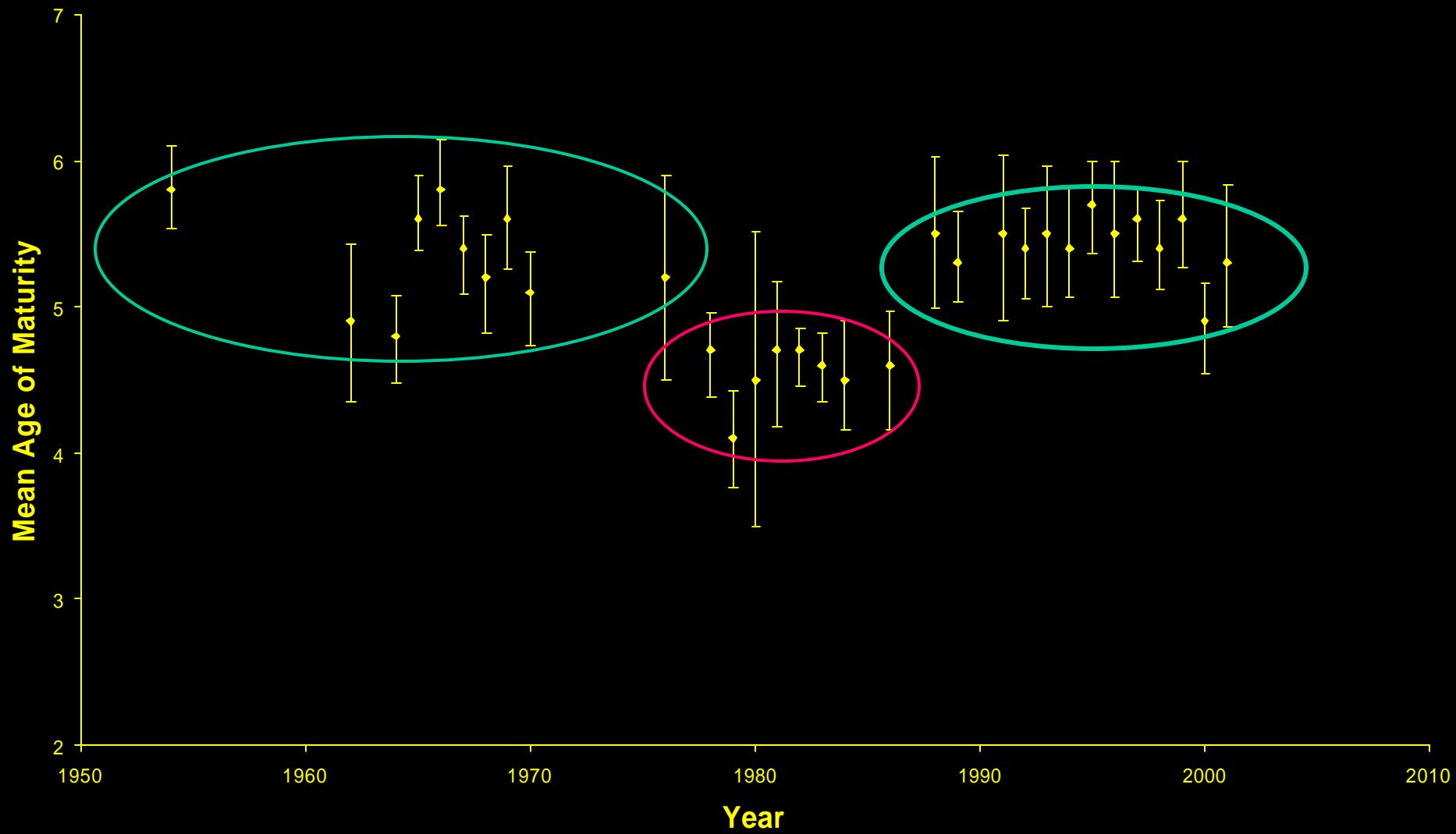
Late Term Fertility



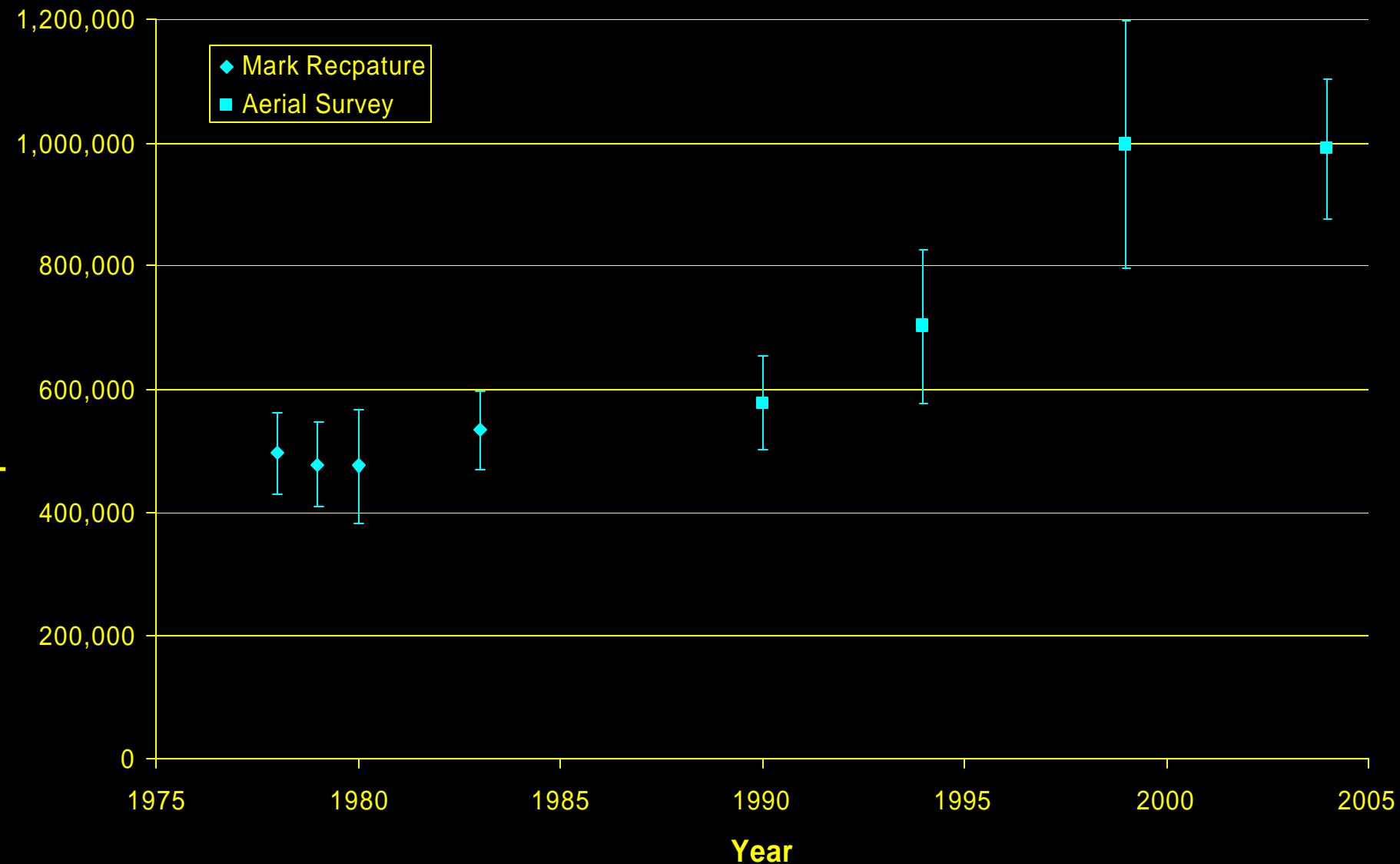
Mean Age of Maturity



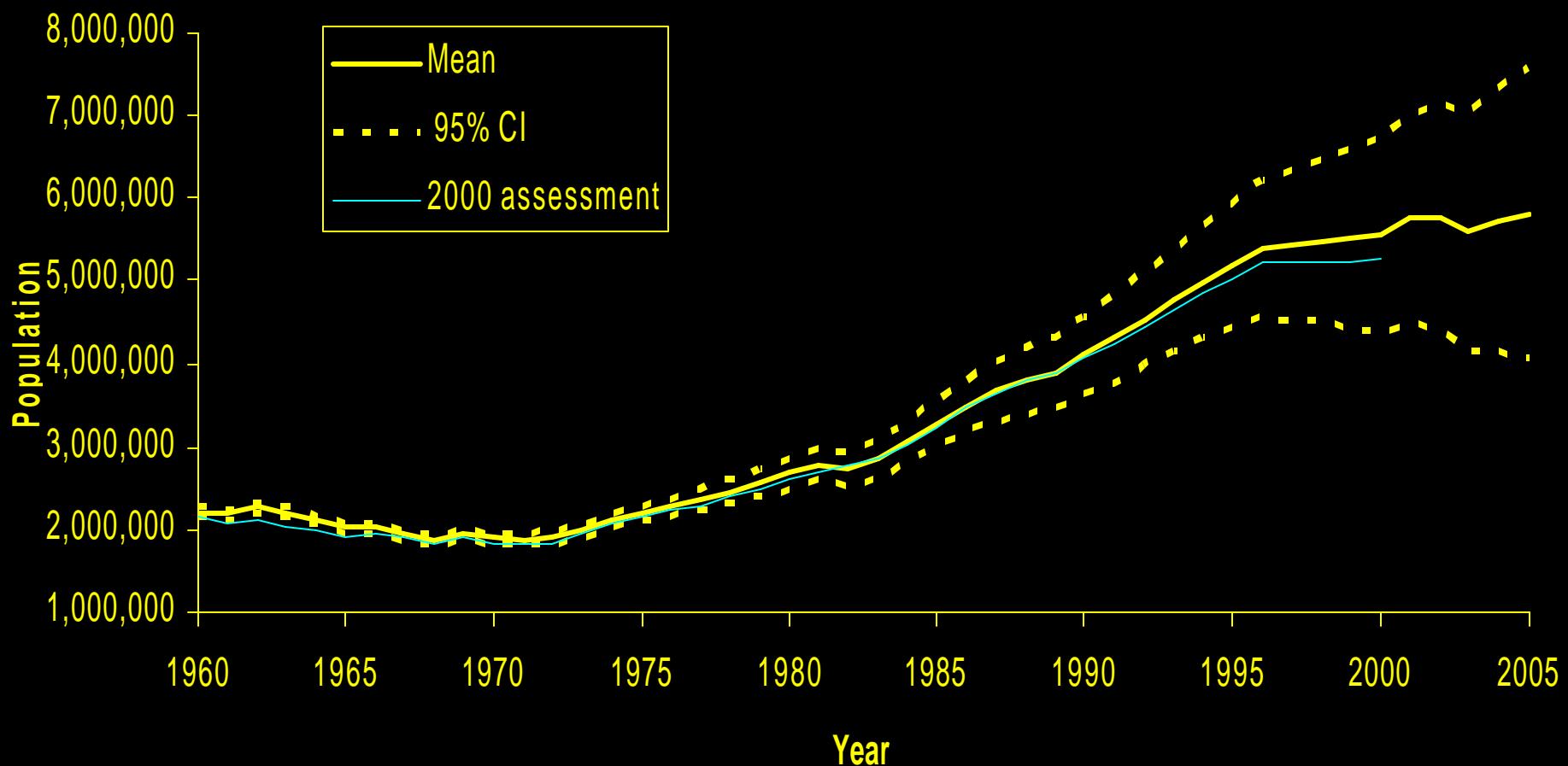
Mean Age of Maturity



Pup Production of Northwest Atlantic Harp Seals



Population Trajectories of NW Atlantic Harp Seals

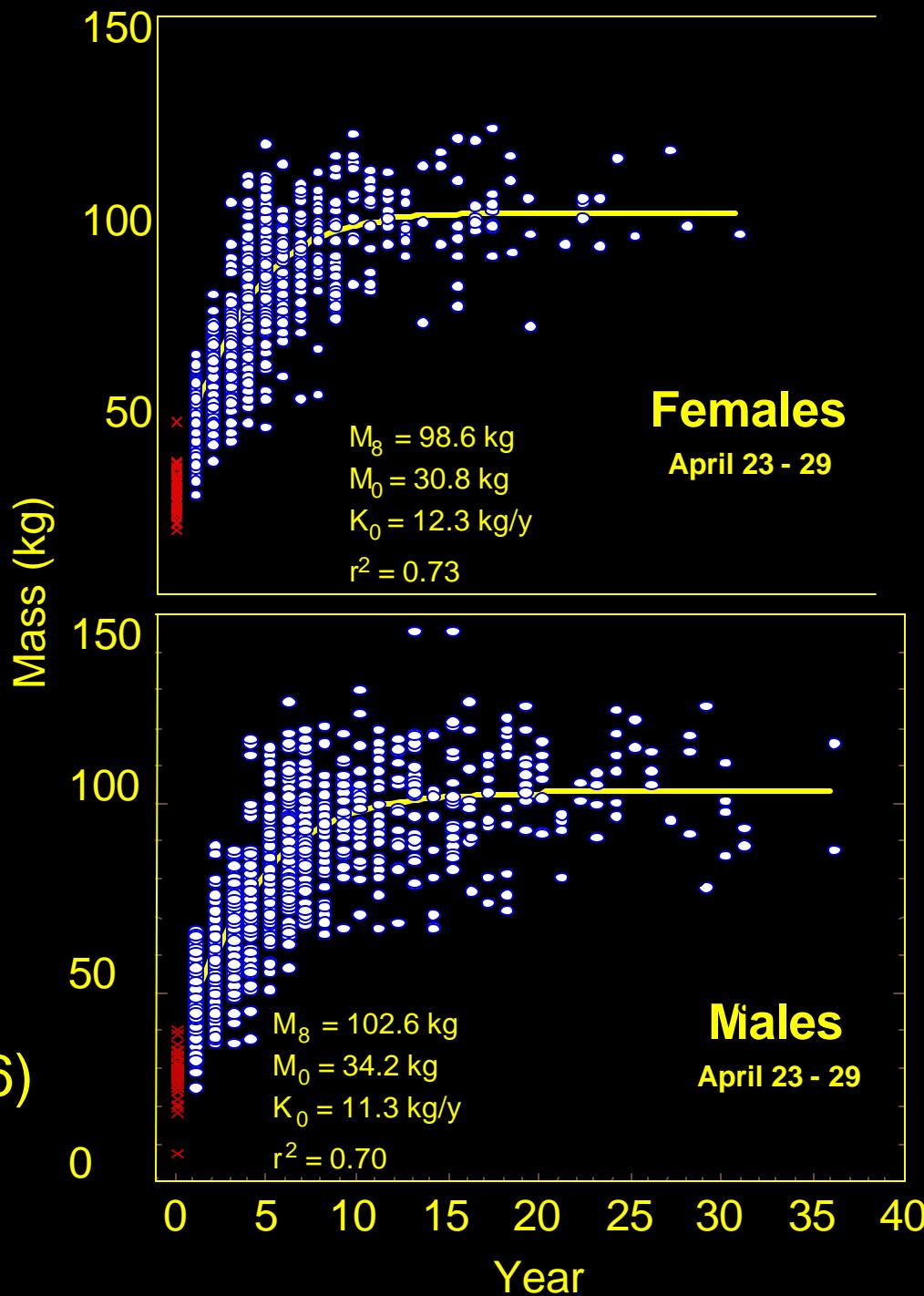


Energy Requirements

$$\text{GEI} = \frac{\text{GF} \bullet \text{AF} \bullet \text{BMR}}{\text{ME}}$$

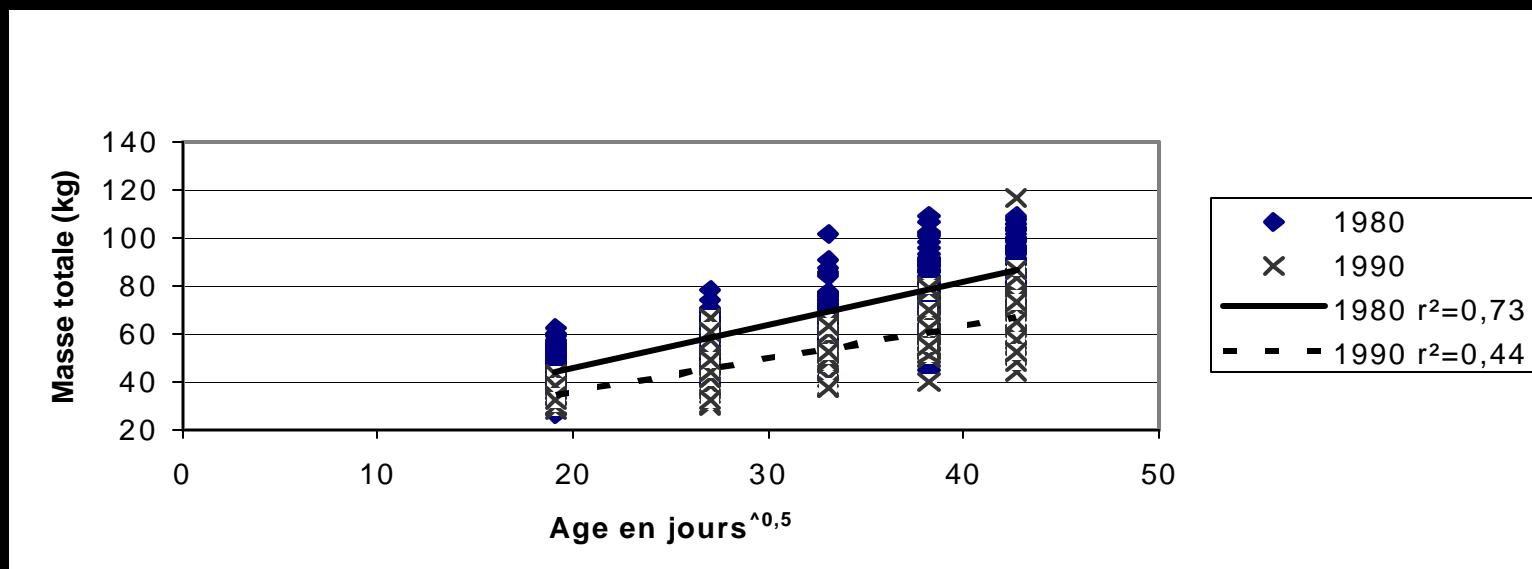
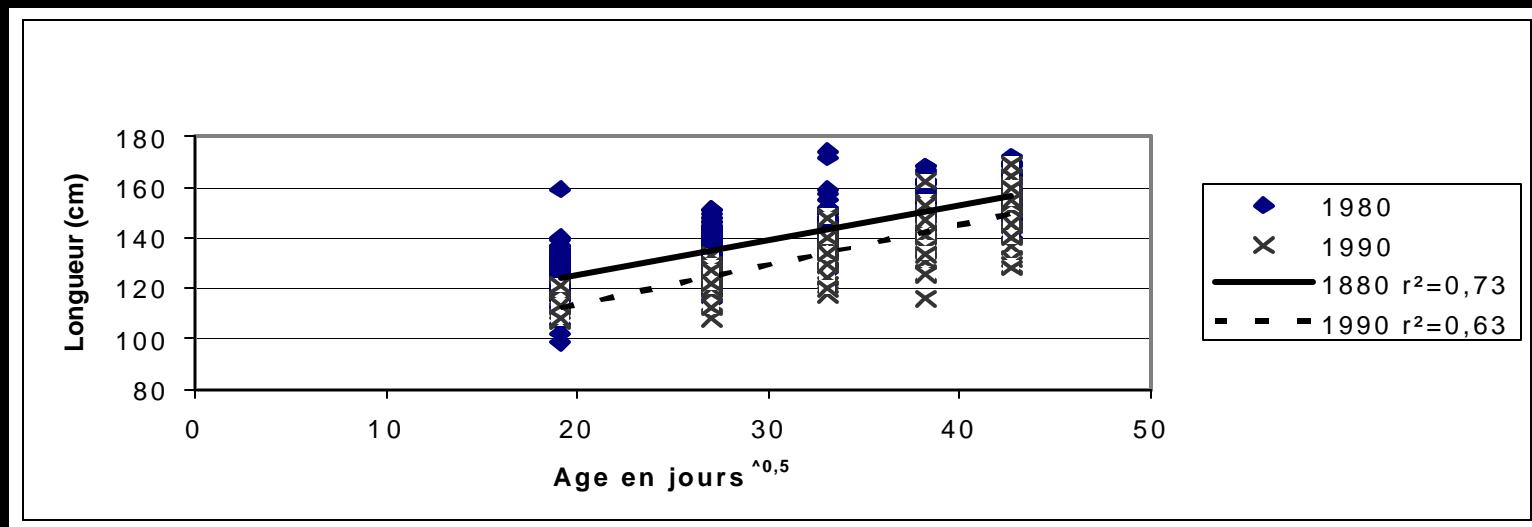
Where:

- **GF** = 1.8, 1.6, 1.4, 1.3, 1.1, & 1.0 for 0 to 5+ yr.
- **AF** = 2 (triangular 1.7 – 3)
- **ME** = 0.83 (uniform 0.8–0.86)
- **BMR** = $293 \times \text{Mass}^{0.75}$



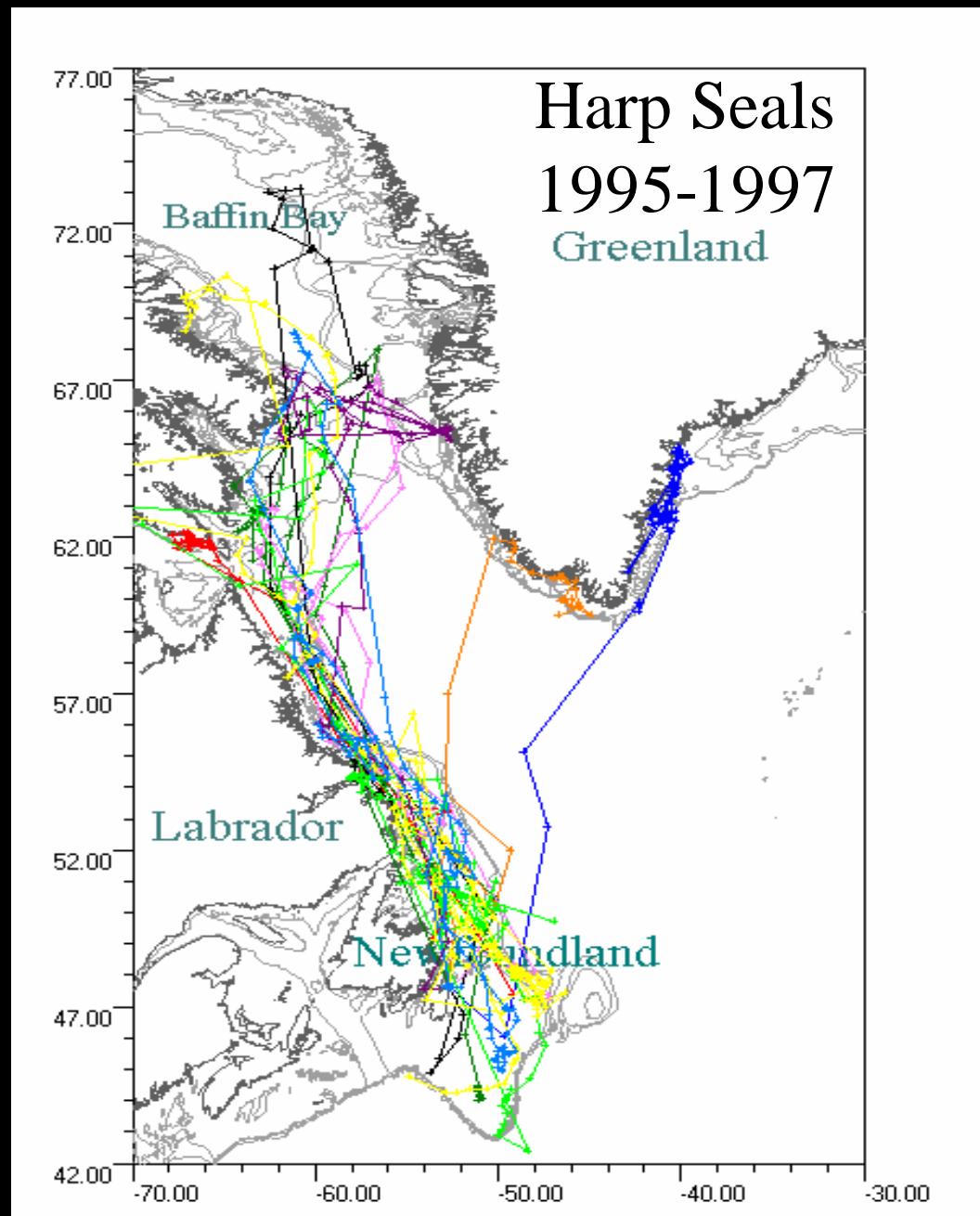
Growth of Female Harps Seals

Vaslet and Chabot 2004



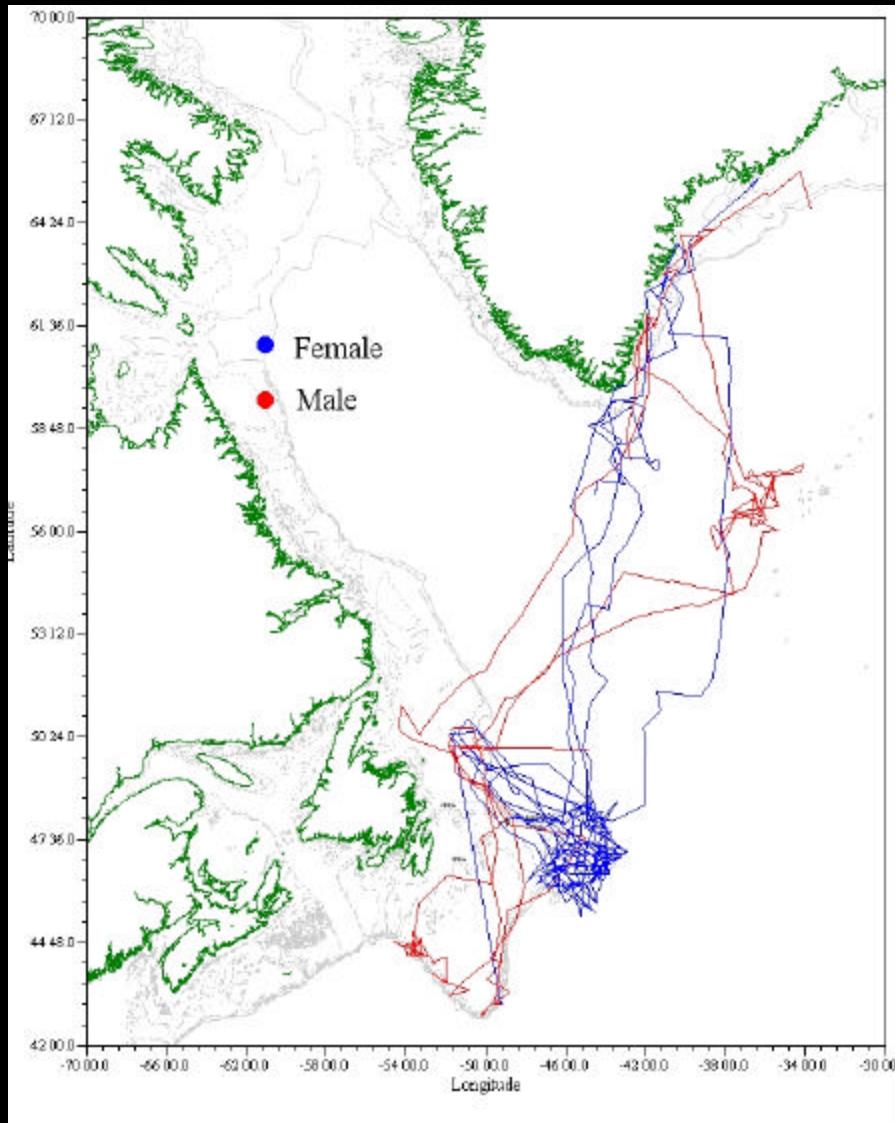
Seasonal Distribution

- Marine mammals tend to be wide ranging, often crossing into different jurisdictions
- Location and timing of movements can vary among years

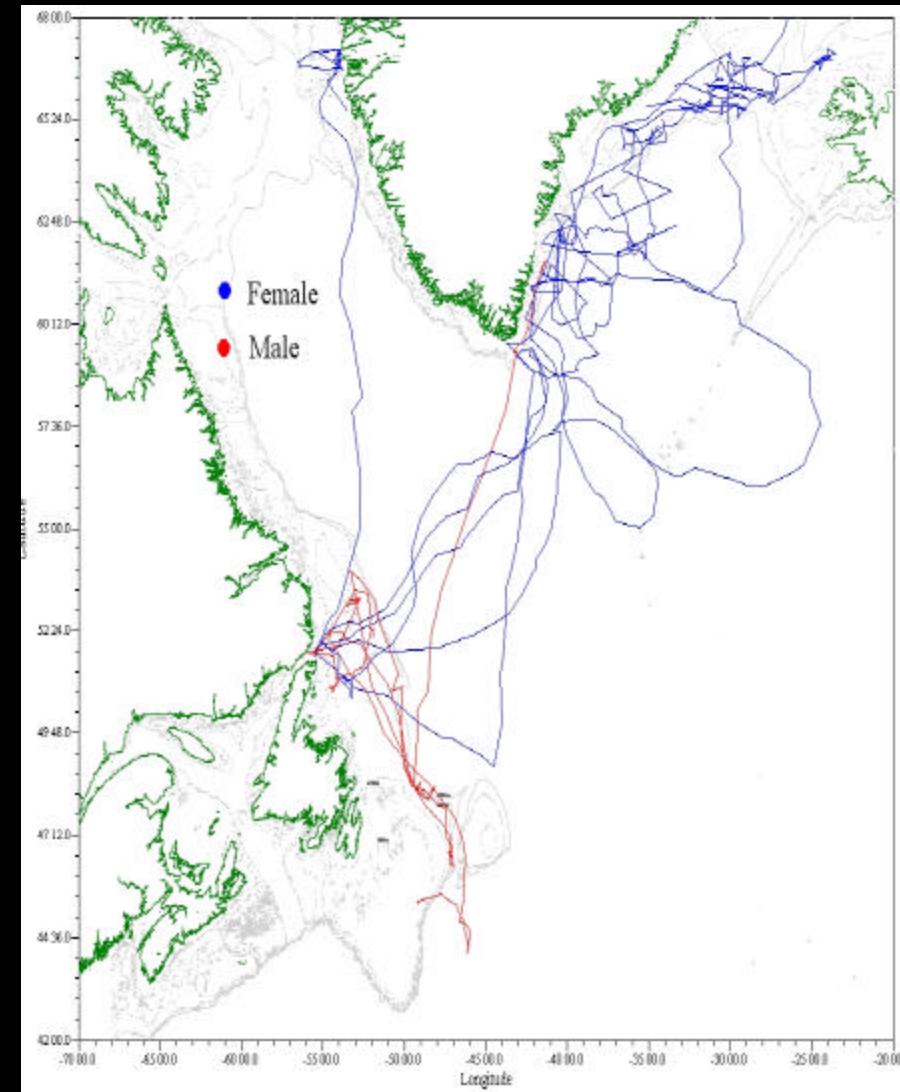


Pre-moult Hooded Seals (March – July)

1994



2004

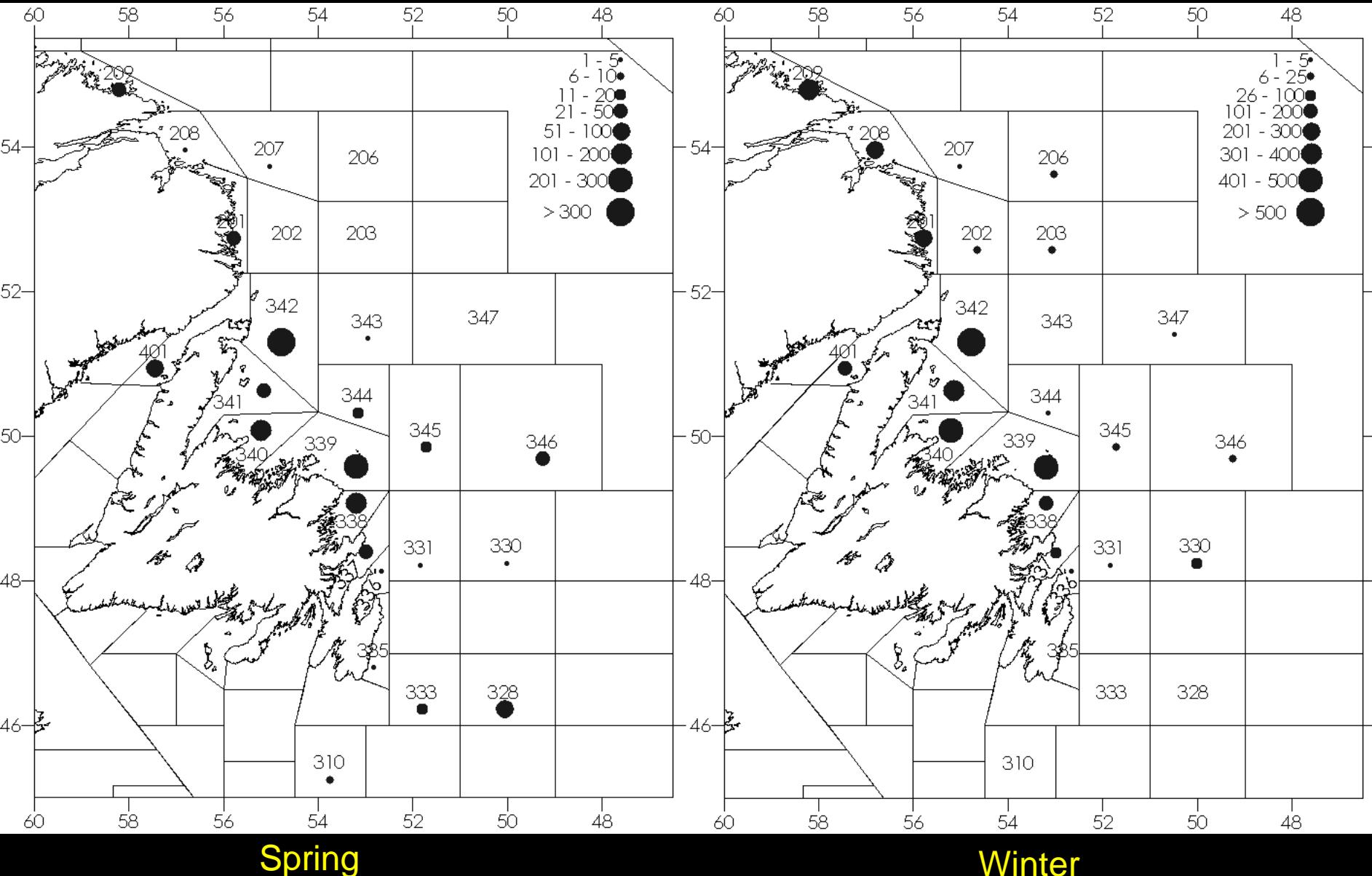


Diet

- Reconstructed > 10,000 stomachs
- Seasonal and Geographical variation
- Local regressions for majority of species
- Resampling individuals to estimate uncertainty



Harp Seal Diet Samples in Newfoundland Water



Harp Seal Diet in Newfoundland (2J3KL) Waters 1980 -2001

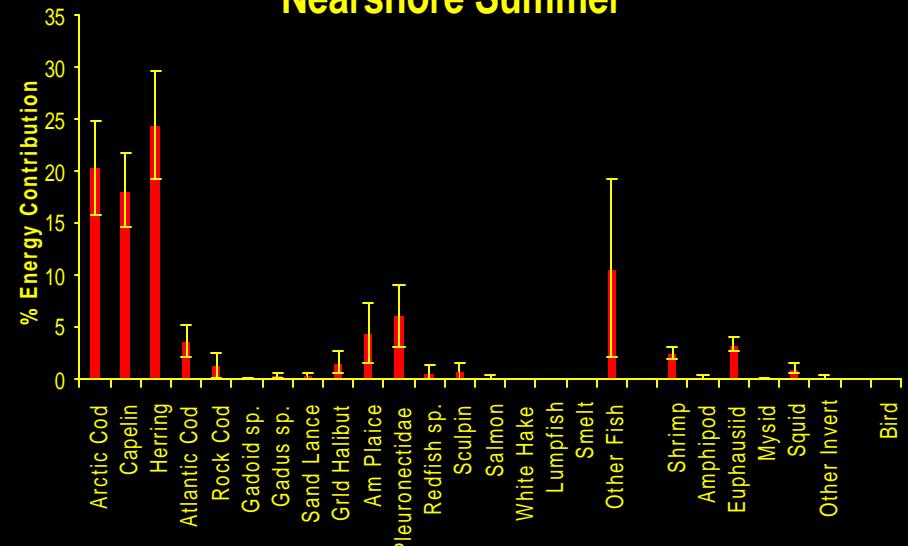
Nearshore Winter



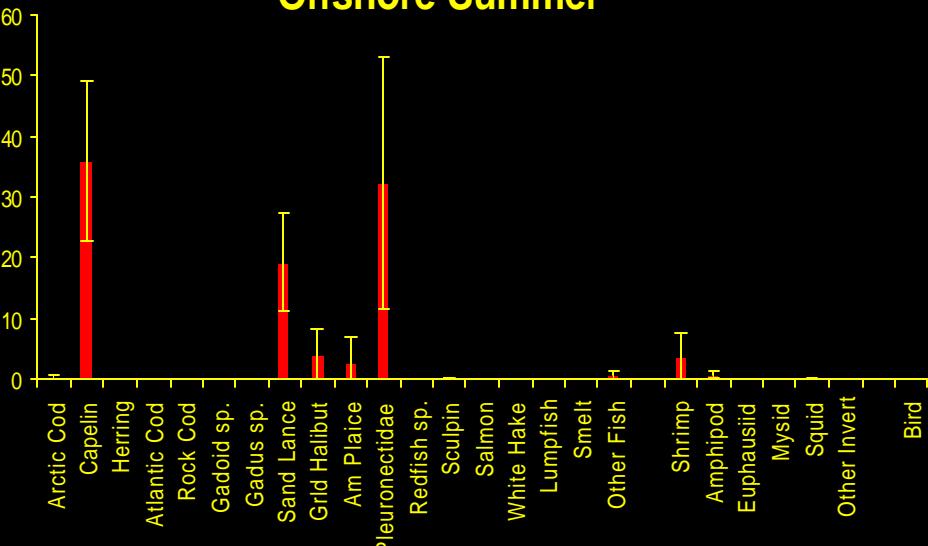
Offshore Winter



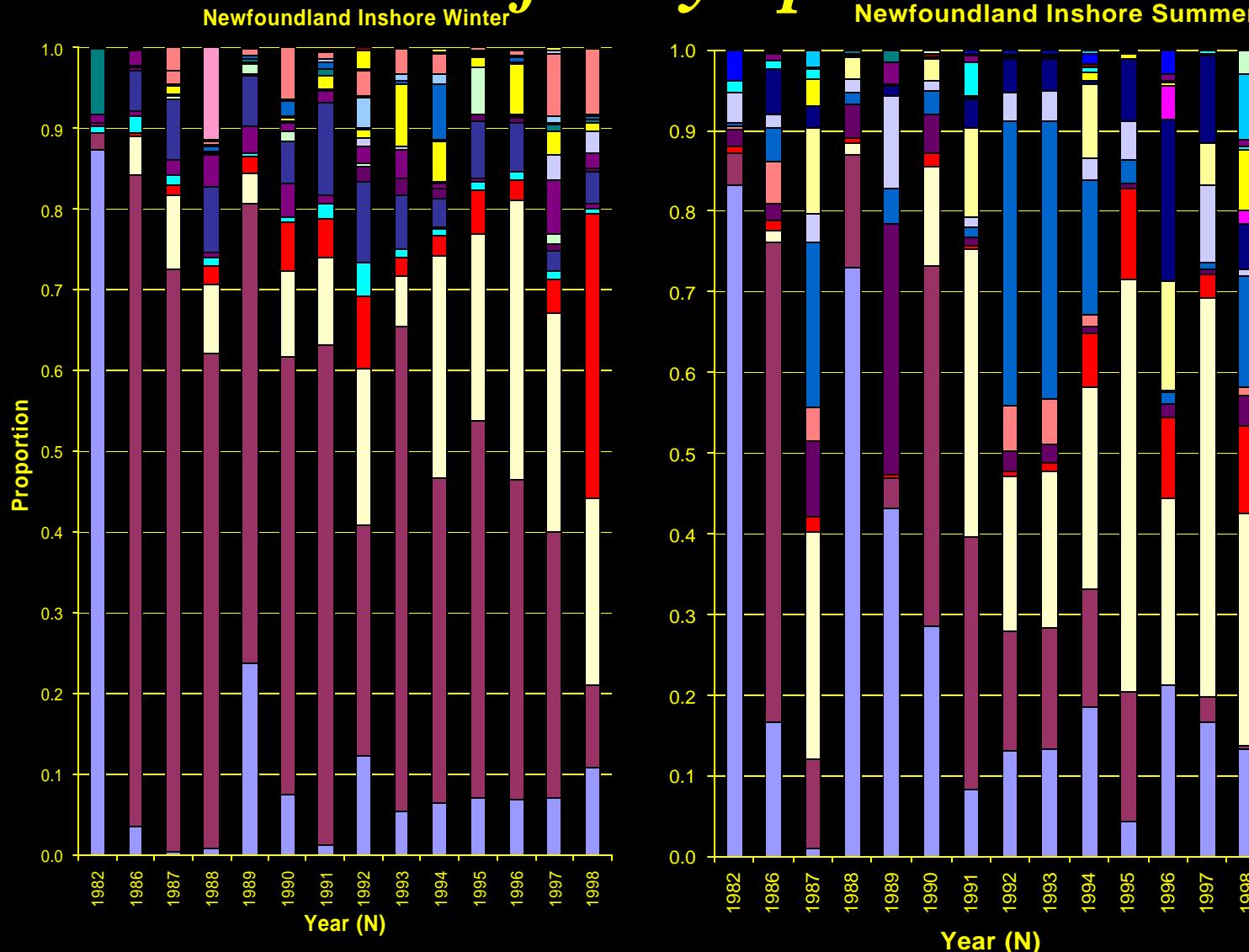
Nearshore Summer



Offshore Summer

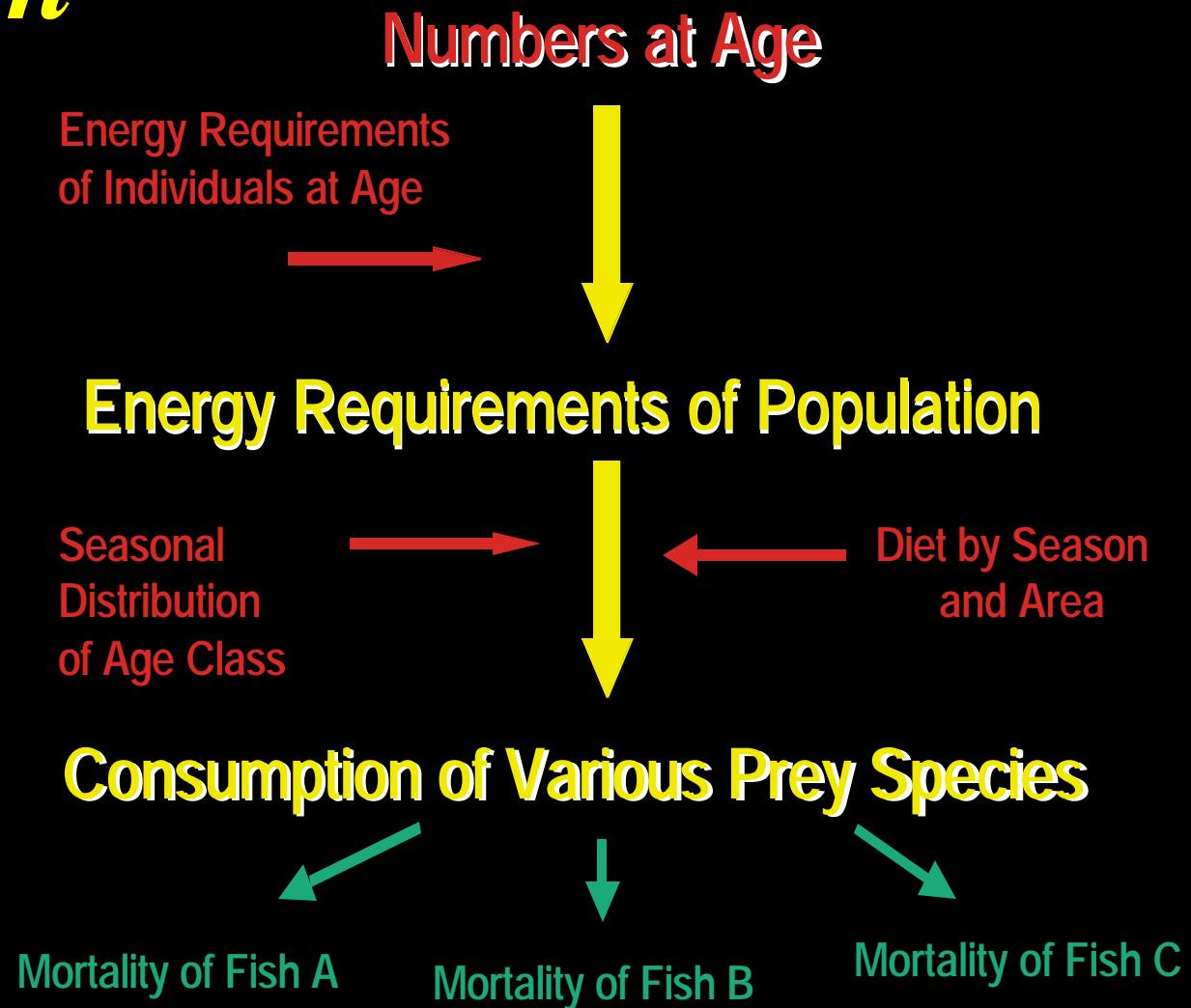


Estimated Annual Energy Contribution of Prey Species

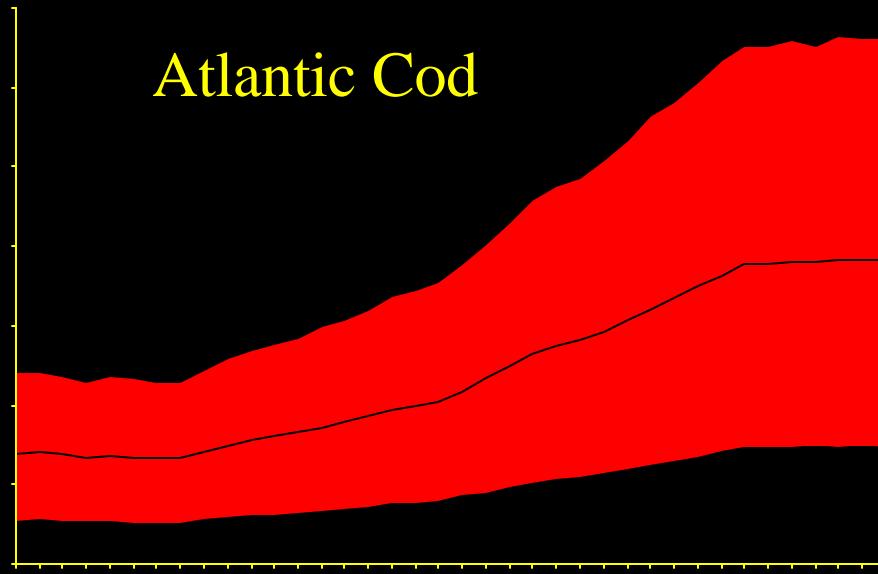
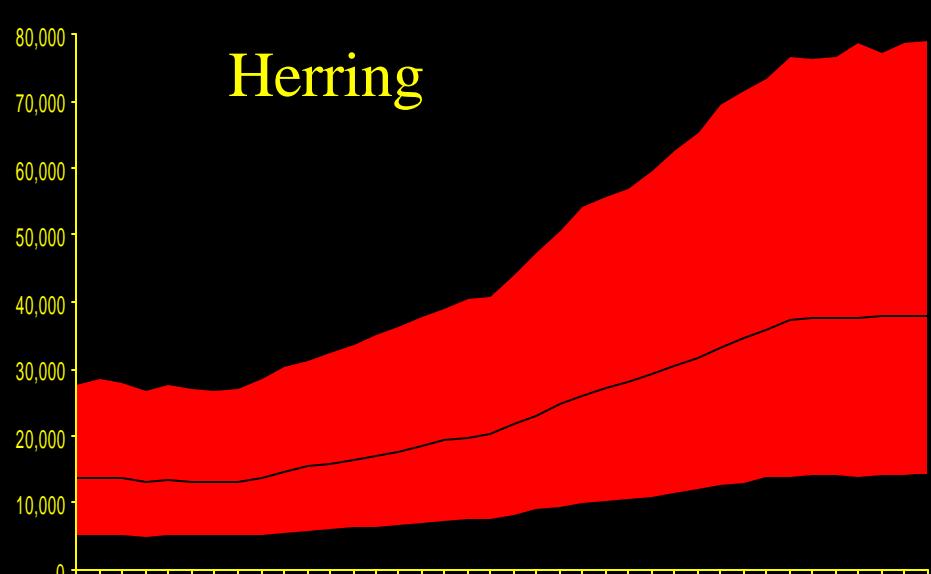
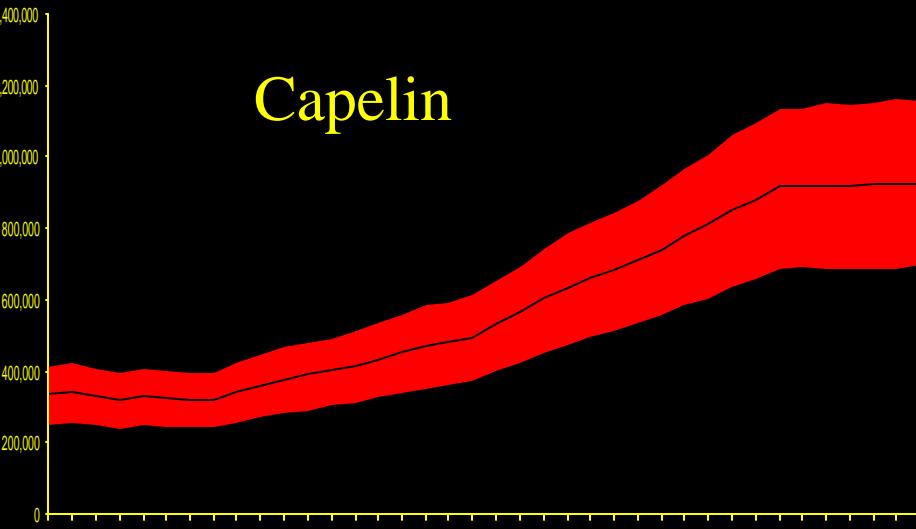
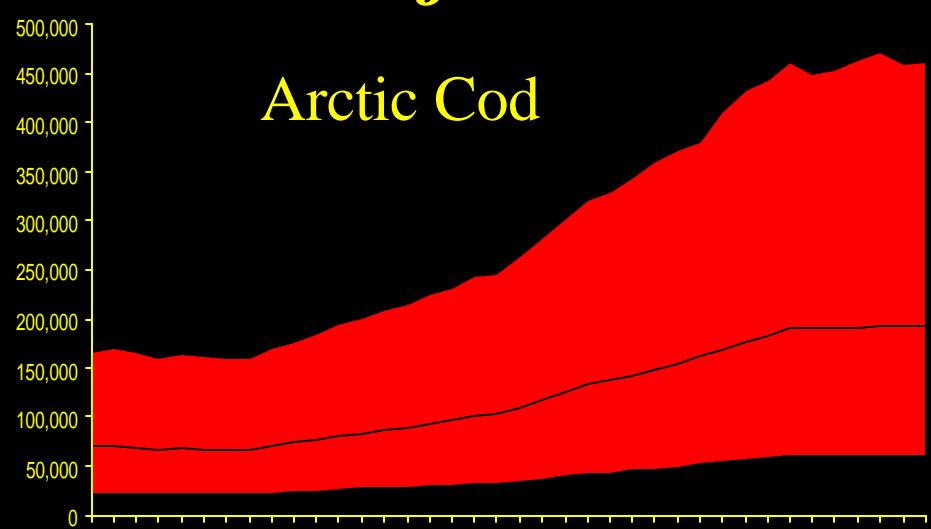


Prey Consumption

- Estimated using average diet 1982, 86-2001
- Quantified uncertainty in abundance, energy requirements, diet, residency



Consumption (Tonnes) by Harp seals in Newfoundland Waters 1965-2002



Conclusions:

Harp seals consume substantial amounts of Atlantic cod and contribute to the high total mortality observed in recent years

Conclusions:

Harp seals consume substantial amounts of Atlantic cod and contribute to the high total mortality observed in recent years

But:

- What is the impact of this mortality on the recovery of cod?
- Would recovery of cod occur if seal predation was reduced?

Ecopath 1985 & 1995



Summary:

- We have collected considerable data on harp seals and are able to estimate consumption of major prey species.
- These estimates are highly imprecise and likely to remain so because of the variability inherent in how animals use their environment.
- This uncertainty must be included in any consideration of their ecological role

Summary:

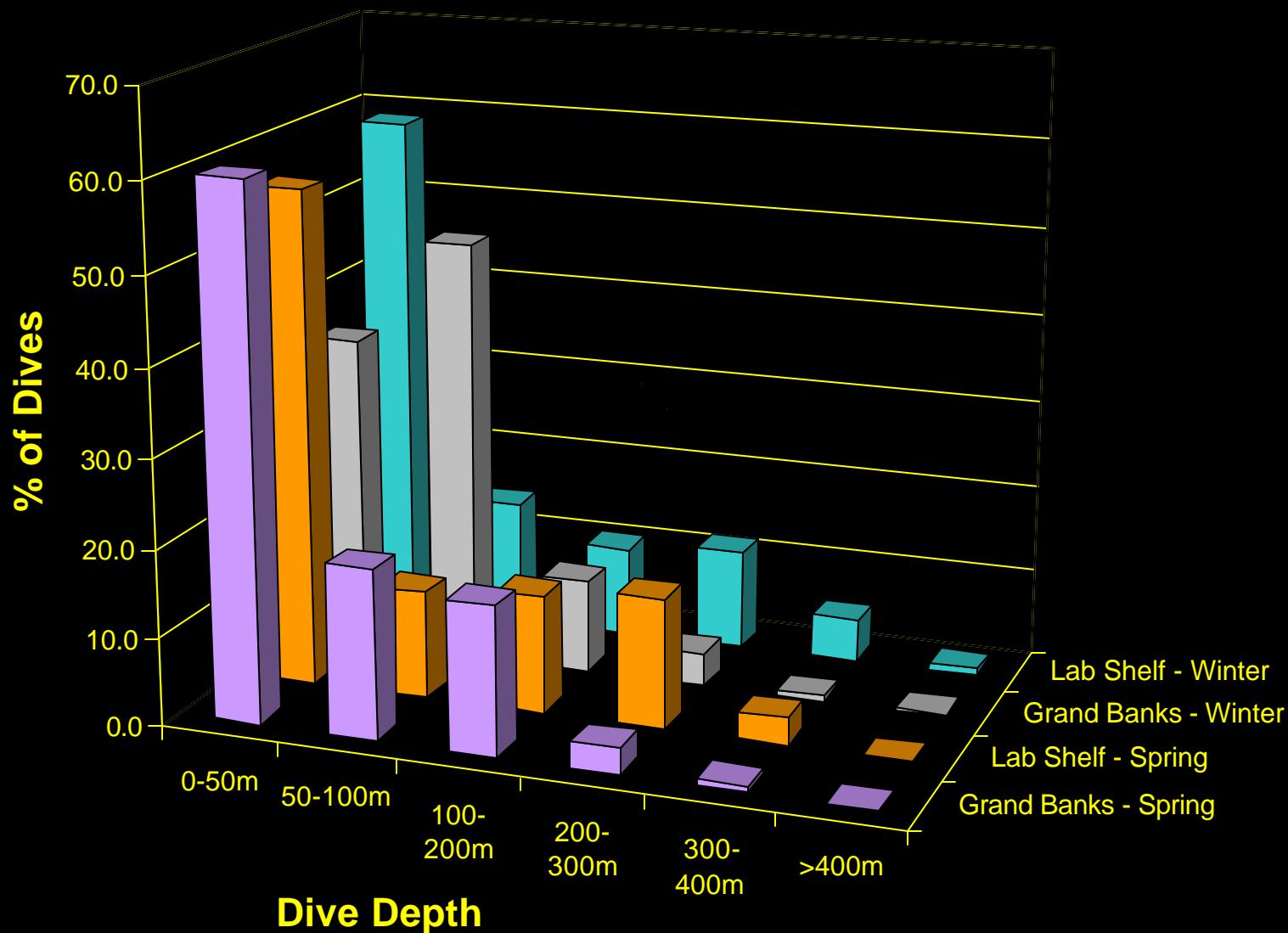
- The impact of predation on their prey is currently not possible to determine to a large part because of lack of knowledge or uncertainty in:
 - Absolute abundance of most prey species
 - Other sources of prey mortality
 - Prey-predator relationships among the majority of marine species
 - The functional relationship between seals and their prey

Questions?

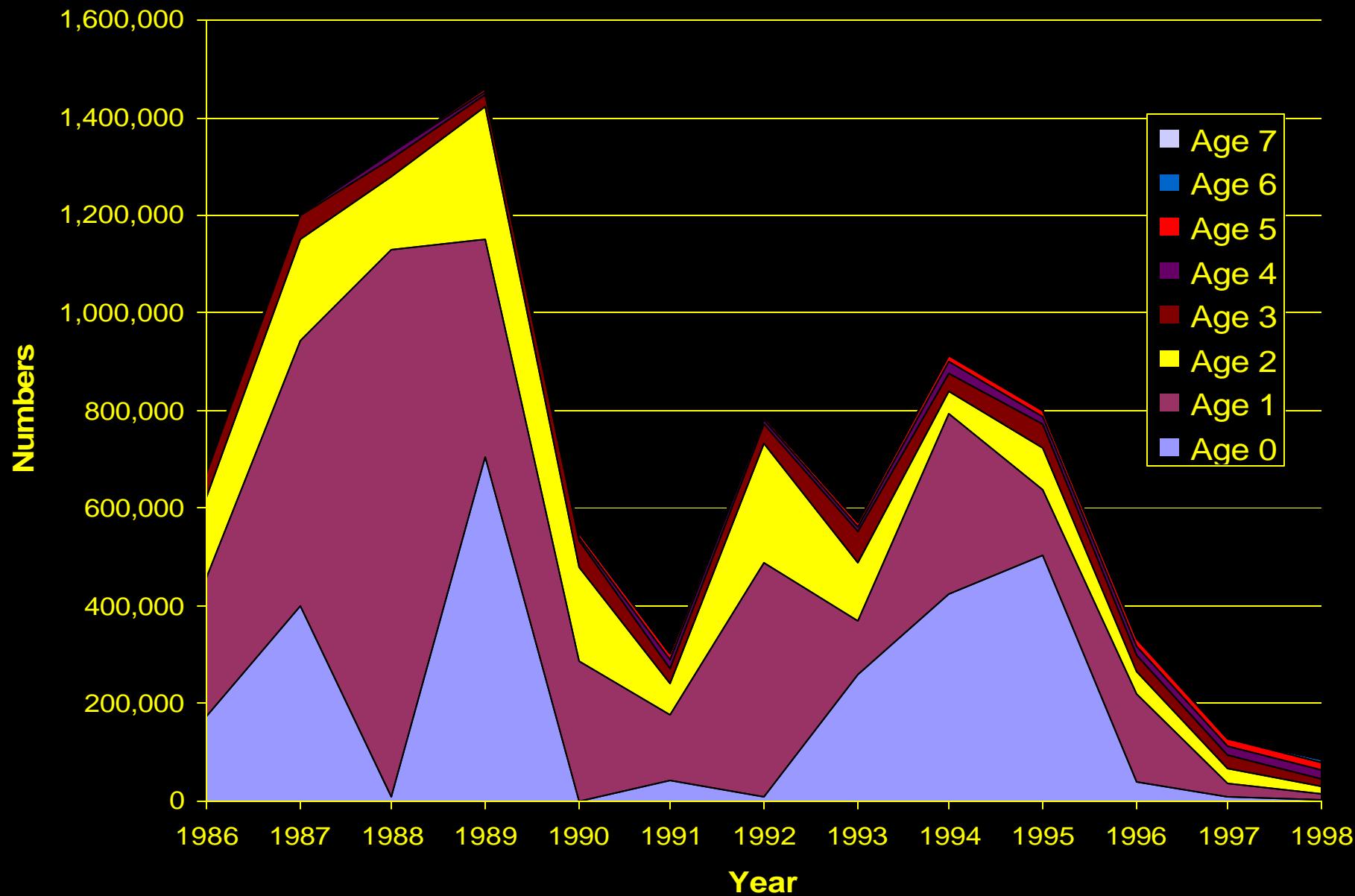


**Harp seals have the
last word on the cod
debacle...**

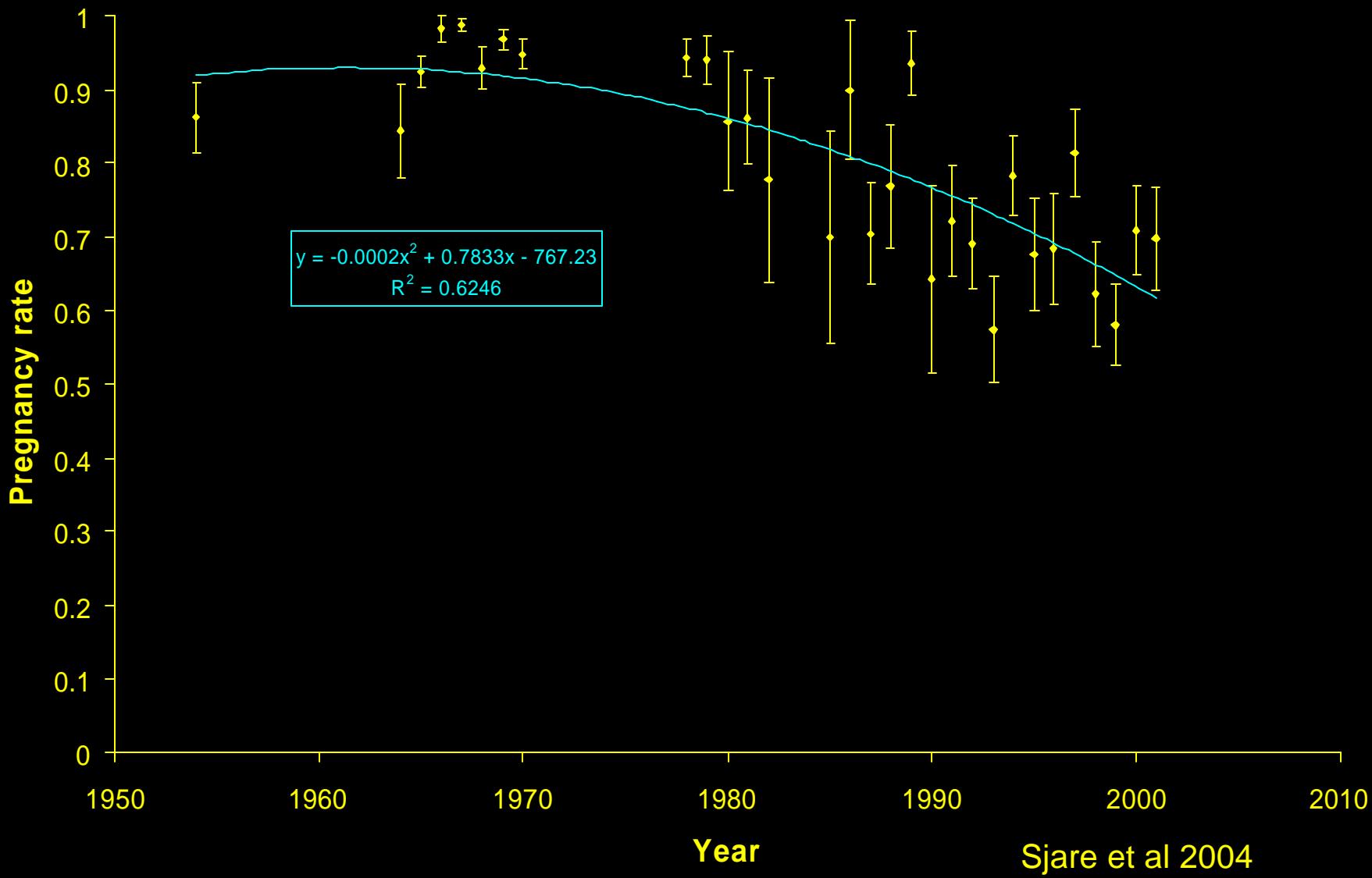
Harp Seal Dive Depths



Numbers of Cod Consumed by Harp Seals on the Newfoundland Shelf



Late Term Fertility



1985 vs. 1995:

- Increase in harp biomass seems to have caused increased mortality on cod and small plaice
- The both cod and plaice are sensitive to the biomass estimate of harps
- Uncertainty on primary production estimates precludes any conclusions on the effect of climate change